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ABSTRACT

To determine if a relationship can be found between school size and academic achievement, a study examined correlations for 566 New Mexico public schools (grades 5, 8, and 11) from 1978 to 1981. The measure of academic achievement used was the schools' average "total scale score" on the Comprehensive Tests of Basic Skills. The two questions to be answered were whether there is a relationship between school enrollment size and student achievement, and whether there is such a relationship when correlations have been made for certain other predictors of achievement. Examining the 12 multiple regression model results (3 grades times 4 years) indicated that in 11 cases, school enrollment size was not significantly related to academic achievement. The study concluded that school enrollment size was not related to academic achievement, and that percentage of students eligible for Title I and percentage of Native American and Spanish American students appeared to be significantly related to academic achievement. Recommendations were that since academic achievement seems unrelated to school size, other factors should be considered when school consolidation is contemplated, and since academic achievement appears highly related to socioeconomic and cultural/ethnic factors, these two areas should be considered when developing new programs. (MH)

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VARIABLES AFFECTING ACADEMIC ACHIEVEMENT IN NEW MEXICO SCHOOLS

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INTRODUCTION

Since the early 1930s, there has been a substantial shift away from small schools and small school districts toward larger consolidated schools and districts. Between 1930 and 1972, the number of elementary and secondary schools in the United States dropped from approximately 262,000 to 90,876 and the number of school districts declined from approximately 128,000 to 16,960 (Sher & Tompkins, 1976, p. 1).

During the 1950s and 1960s, there was a tremendous push toward consolidation of small schools. The primary consensus on the part of education professionals was that consolidation was the panacea for almost all the rural and small school's problems. The public was told that the very small schools were not cost effective and could not provide quality education for their children; however, consolidation of the smaller schools and districts could overcome both the cost and quality aspects and provide a better education for all children. Because of this perception many states, including New Mexico, elected to consolidate the smaller schools and districts wherever possible. However, rural parents often objected, they "...did not want their children going to distant, unfamiliar schools," or "... feared the effects of such consolidation on the life and vitality of their individual communities" (Sher & Tompkins, 1976, p. 2). School consolidation also brought unexpected social and economic shifts in the rural populations. When small townships or villages lost their schools, they often lost an economic base as well

as a major portion of their small population. Due to parental objections and the shifts in rural populations, political controversy often ensued over whether small schools could remain open. With the political controversy came debates over the optimum size of schools and how small a school could be and still remain open (when consolidation was a viable option). The focus of the school size issue has usually encompassed two main aspects: (1) the academic achievement of the students and the quality of programs, and (2) the cost per pupil of operating the school. Yet the primary motivator for considering whether schools should be consolidated has usually focused on the second aspect, per-pupil cost rather than academic achievement of the students.

After the early 1970s, new factors began entering the complicated political equation. Busing, once considered extremely cost effective, no longer looked as attractive; the "New Federalism" mood brought in with the Reagan administration created a climate in which "bigger" is not always better; and finally, the back-to-basics movement seemed to give the appearance that perhaps the "little-red-school-house" had the right idea on how to teach the students. However, there continued to be lingering doubts by many educators that small schools could academically prepare students as well as larger schools. Hess and others point out that even after no relationship between school size and quality was found, the Washington State Temporary Special Levy Study Commission concluded that "... it is generally agreed that very small schools cannot

compete favorably with larger schools" (Hess and others, 1978, p. 13).

STATEMENT OF THE PROBLEM

Most arguments against small schools' equality of academic achievement are based on intuitive speculation. This study intends to examine the issue with empirical data and determine if a relationship can be found between school size and academic achievement when corrections have been made for certain other predictors of achievement.

A substantial amount of research has already examined the cost issues in public schools. This study will not attempt to consider the cost aspect: it focuses only on academic achievement of students in the public schools.

There are many measures of academic achievement, but for the purposes of this study only a school average "total scale score" on the Comprehensive Tests of Basic Skills (CTBS) will be used.

THE QUESTIONS

The first question to be examined is, Is there a relationship between school enrollment size and student achievement?

To find the answer, this study examined the simple correlation of school size with academic achievement. Many earlier studies have found there is a significant relationship between school size and achievement (Alexander & Woodruff, 1940; Boles, 1952; Clements, 1969; Downey, 1978; Giesbrecht, 1978; James, 1955; Street, Powell, & Hamblen, 1962; Zetler, 1970;). The results contradicted each other. In some cases, small schools had higher achievement, and in other

cases, larger schools had the higher achievement. This study examined the simple correlations for New Mexico schools in the years 1978, 1979, 1980, and 1981 to determine if a relationship could be found.

The second question to be examined is, Is there a relationship between school enrollment size and student achievement when corrections have been made for certain other predictors of achievement? To answer this question the partial F value (of school enrollment size) in a regression analysis of variance was used to determine the school size relationship when other variables had been included in the model.

Schools in New Mexico offer a good opportunity to examine these questions. Per-pupil funding of schools in New Mexico is relatively constant, with the state government paying the largest share of the operating budget and the local and federal governments providing only a small percentage of funds. The State Department of Education for New Mexico has gathered standardized achievement data from all districts for many years. This data base provides an opportunity for an in-depth study of the relationship of school enrollment size to student academic achievement.

DESCRIPTION OF THE VARIABLES

The sample for this study was limited to grades five, eight, and eleven in New Mexico public schools. The dependent variable, academic achievement, was the mean "total scale score" for each school as measured on the CTBS test given in years 1978, 1979, 1980,

1981. The independent variable of school enrollment size was the 120th day enrollment figures for each school as provided by the Title I office at the New Mexico State Department of Education. The control variables were (1) percentage of students eligible for Title I programs in the schools, (2) the percent of students in special education in the district, (3) the pupil/teacher ratio of the district, (4) the average district salary for teachers in the district, (5) the average years of teaching experience of teachers in the district, (6) the percentage of teachers with master's or higher degrees in the district, (7) the percentage of Spanish-American students in the district, (8) the percentage of Native-American students in the district, (9) the mobility rate of students in the district, and (10) the expenditures per pupil in the district.

DESCRIPTION OF THE DATA

The experimental unit for this study is the individual public schools in New Mexico for the years 1978, 1979, 1980, and 1981. Each school has a criterion variable (average achievement scale score on the CTBS) and eleven independent variables that are associated with that particular school and year. The average student achievement results for the schools were limited to grades five, eight, and eleven.

Table 1 lists the number of schools at each grade level for each year that data were available.

TABLE 1
NUMBER OF SCHOOLS USED IN THE STUDY

	YEARS			
	1978	1979	1980	1981
GRADE 5	320	323	323	323
GRADE 8	138	138	138	138
GRADE 11	105	105	105	105

METHODOLOGY

Two major questions are examined in this study; 1) Is there a relationship between school enrollment size and student achievement? and 2) Is there a relationship between school enrollment size and student achievement when corrections have been made for certain other predictors of achievement?

The approach used for this study was correlational in nature. The statistical analysis used to answer the first question is a simple Pearson correlation of school size with achievement. The statistical procedure used to answer the second question was multiple regression using a partial F test (the procedure is explained in Draper and Smith, 1966). The data consisted of three grade levels (fifth, eighth, and eleventh) and four years of test results (1978, 1979, 1980, and 1981). Thus, for each question there are twelve hypotheses (three grades times four years).

RESULTS

The Pearson Correlation results for the first question showed that the data was significant in six of the twelve cases (grade 5

year 1979, 1980; grade 11 year 1978, 1979, 1980 and 1981).

The results of the second question were examined through the regression analysis. Table 2 presents a summary of the variables that were significant in the complete model with eleven independent variables. The R squared for the total model with eleven independent variables ranged from 0.465 to 0.674 . In most cases, the proportion of total variation about the mean that was explained by the regression was over fifty percent. The F values for the complete model were significant at alpha equal to or less than 0.0001 probability. The control variable that appears to have the most influence on the model was percent of students eligible for Title I funds. The partial F value of the Title I variable was significant at alpha less than 0.05 level in all twelve models. Other control variables that were statistically significant (probability less than 0.05) in at least two of the models were the following:

1) Percentage of Native-American students (significant in nine of the models with negative Beta values).

2) Mobility rate of the students (significant in four of them models with three negative Beta values and one positive Beta value).

3) Percentage of students enrolled in special education (significant in three of the models with positive Beta values).

4) Percentage of Spanish-American students (significant in three of the models with negative Beta values).

5) Average years of teaching experience (significant in two of the models with positive Beta values).

Table 3 presents a summary of the variables that were

significant in the forward selection model. The R squared ranged from 0.464 to 0.656. In most cases the variables in the forward selection models accounted for over fifty percent of the variability in the dependent measure of academic achievement.

The F values for the forward selection models were all significant at alpha equal to or less than 0.0001 probability. The control variable that appears to have the most influence on the forward selection model is percentage of students eligible for Title I funds. The partial F value of the Title I variable was significant at alpha less than 0.05 level in all twelve models. Other control variables that were statistically significant (probability less than 0.05) in at least two of the forward selection models were the following;

1) Percentage of Native-American students (significant in ten of the models with negative Beta values).

2) Percentage of Spanish-American students (significant in five of the models with negative Beta in three eleventh grade models and positive in two fifth grade models).

3) Per pupil expenditure (significant in four of the models with positive Beta values).

4) Percentage of students enrolled in special education (significant in two of the models with positive Beta values).

5) Mobility rate of the students (significant in two of the models with negative Beta values).

6) Teachers salaries' (significant in two of the models with positive Beta values).

TABLE 2
RESULTS OF THE TOTAL REGRESSION ANALYSIS OF VARIANCE
FOR ACADEMIC ACHIEVEMENT REGRESSED ON SCHOOL SIZE
AND THE CONTROL VARIABLES

	Grade 5		Grade 8		Grade 11	
	Total R-Sq	Significant Variables	Total R-Sq	Significant Variables	Total R-Sq	Significant Variables
Year 1978	.465	1) Title 1 2) Native American	.557	1) Title I 2) Pupil/ Tch ratio 3) Expdt	.646	1) Title I 2) Mobility Rate 3) Size
Year 1979	.513	1) Title I 2) Native American	.620	1) Title I 2) Teaching Experience 3) Native American	.637	1) Title I 2) Spanish American 3) Native American
Year 1980	.477	1) Title I 2) Special Education	.674	1) Title I 2) Native American	.586	1) Title I 2) Spanish American 3) Native American
Year 1981	.487	1) Title I 2) Special Education 3) Teaching Experience 4) Native American 5) Mobility Rate	.596	1) Title I 2) Special Education 3) Native American 4) Mobility Rate	.616	1) Title I 2) Spanish American 3) Native American

*Note: All eleven independent variables are in the model.

TABLE 3
RESULTS OF THE FORWARD SELECTION REGRESSION ANALYSIS OF VARIANCE
FOR ACADEMIC ACHIEVEMENT REGRESSED ON SCHOOL SIZE AND
AND THE CONTROL VARIABLES

	Grade 5		Grade 8		Grade 11	
	Total R-Sq	Significant Variables	Total R-Sq	Significant Variables	Total R-Sq	Significant Variables
Year 1978	.464	1) Title 1 2) Native American 3) Salary	.546	1) Title I 2) Pupil/ Tch ratio 3) Expdt 4) Salary	.630	1) Title I 2) Special Ed 3) Native American 4) Size
Year 1979	.510	1) Title I 2) Native American 3) Spanish American	.596	1) Title I 2) Teaching Experience	.623	1) Title I 2) Native American 3) Spanish American
Year 1980	.468	1) Title I 2) Spanish American 3) Native American	.656	1) Title I 2) Native American 3) Expdt 4) Percent Tch with MA+	.567	1) Title I 2) Spanish American 3) Native American
Year 1981	.476	1) Title I 2) Native American 3) Mobility rate 4) Expdt	.585	1) Title I 2) Special Education 3) Native American 4) Expdt	.569	1) Title I 2) Spanish American 3) Native American 4) Mobility Rate

SUMMARY

Correlation coefficients between school enrollment size and the criterion variable academic achievement ranged from 0.01 to 0.30: all coefficients were in the positive direction. These findings somewhat parallel James' (1955) study using rank order correlations. His study showed positive correlations between school size and science achievement, social studies and English achievement. The mathematics test showed a negative correlation. In James' study, almost all the probability levels were non-significant; yet in this present study half of the simple correlations are significant.

It is also interesting to note that in the present study all four tests (in years 1978, 1979, 1980, and 1981) were significant in the eleventh grade. It would appear from this that school size might play a larger role in academic achievement in the later years of schooling (high school) than the earlier years (elementary and junior high). Yet the correlation coefficients alone do not provide enough insight into what effect school size may have on academic achievement. Size must be placed into context with other variables that may influence academic achievement; therefore, twelve multiple regression models were examined.

In examining the twelve multiple regression model results, it was determined that in eleven of the twelve cases school enrollment size could not be shown to be significantly (in statistical terms) related to academic achievement. Due to chance alone, it is reasonable to assume that at least one time in twelve the models would show a significance result. This was observed in the eleventh grade of year 1978. From the available data, there is no reason to believe that school enrollment size is related to academic achievement.

A secondary observation which came out of the multiple regression, and which was not related to school size, proved interesting and will be discussed here. The variable used to control for socioeconomic factors was "percentage of students eligible for Title I program in the school". The Title I variable was negatively related to academic achievement. In the fifth grade for all years examined this variable alone accounted for the largest percentage of variability in the model. In the eighth and eleventh grades the Title I variable was still significant but other variables were beginning to account for a sizable portion of the variability. (Examples: percentage of Native-American students, percentage of Spanish-American students, percentage of students in special education) The primary variable in the eleventh grade was Title I although two other variable had become extremely important they were: percentage of Native-Americans and to a smaller extent percentage of Spanish-Americans. The percentage of Native-Americans and percentage of Spanish-Americans were negatively related to academic achievement in the eleventh grade.

CONCLUSIONS

1. From the data in this study there is no reason to believe that school enrollment size is related to academic achievement.

2. The percentage of students eligible for Title I appears to be significantly related to academic achievement.

3. The ethnicity variables (percentage of Native American students and percentage of Spanish-American students) appears to be significantly related to academic achievement.

4. The percentage of students eligible for Title I appears to be the primary contributing variable in all the models, and the ethnicity variable

(percentage of Native-American students) is the second most significant variable. RECOMMENDATIONS

- Since academic achievement does not seem to be related to school size, then factors other than achievement should be considered when consolidation is being contemplated.

- Policymakers should be aware that academic achievement appears to be highly related to socioeconomic factors, and secondarily related to cultural or ethnic factors. If they wish to improve academic achievement, these two areas should be be considered when developing any new programs.

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